

REMARKS/ARGUMENTS

This Amendment is being filed in response to the Advisory Action mailed on March 9, 2011 from the U.S. Patent and Trademark Office in reply to Applicants' response filed on February 28, 2011 to the Final Office Action mailed on December 27, 2010 from the U.S. Patent and Trademark Office, in which claims 1, 5, 8, 11-16, 19 and 20 were rejected. With this Amendment, claims 1, 5 and 19 have been amended, and new claims 21-27 have been added. No new matter is added with this Amendment. At least some of the claim amendments are for clarification purposes only. Support for the amendments to the claims and new claims 21-27 are found throughout the Applicants' specification as filed, including at least page 5, lines 19-24; FIG. 1; Examples 1-9; and the original claims. Thus, Applicants respectfully request reconsideration and allowance of pending claims 1, 5, 8, 11-16 and 19-27.

The Final Office Action rejected claims 1, 5, 8 and 11-16 under 35 U.S.C. § 103(a) as allegedly being unpatentable over U.S. Patent No. 6,361,697 to Coury et al ("Coury") in view of "Evidence of Stable Hydroxyl Radicals and Other Oxygen Radical Species Generated by Interaction of Hydrogen Peroxide with Magnesium Oxide", *J. Phys. Chem.* 1993, Vol. 97, pp. 5735-5470 to Giamello et al. ("Giamello"). The Final Office Action rejected claim 19 under 35 U.S.C. § 103(a) as allegedly being unpatentable over Coury in view of Giamello as applied to claims 1, 5, 8 and 11-16 above, and further in view of "Determination of Hydroxy Radicals in an Advanced Oxidation Process with Salicylic Acid Trapping and Liquid Chromatography", *J. of Chrom. A* 1998, Vol. 796, pp. 283-288 to Jen et al. ("Jen"). The Final Office Action also rejected claim 20 under 35 U.S.C. § 103(a) as allegedly being unpatentable over Coury in view of Giamello as applied to claims 1, 5, 8 and 11-16 above, and further in view of "Determination of Photochemically Produced Hydroxyl Radicals in Seawater and Freshwater", *Marine Chemistry* 1990, Vol. 30, pp. 71-88 to Zhou et al. ("Zhou").

Rejections Under 35 U.S.C. § 103(a)

The Final Office Action rejected claims 1, 5, 8 and 11-16 under 35 U.S.C. § 103(a) as allegedly being unpatentable over Coury in view of Giamello. Applicants respectfully disagree.

It is respectfully submitted that Applicants do not concur with the Final Office Action analysis of the claims of the present application and the Coury and Giamello references. Nevertheless, in order to expedite prosecution of the present application, pending independent claim 1 has hereby been amended, *inter alia*, to recite the following:

- “supplying a suspension of magnesium oxide to the hydrogen peroxide containing mixture at a and adjusting a pH of the mixture containing hydrogen peroxide and magnesium oxide to a value of from 7.2 to 9.7, the magnesium oxide concentration within the said mixture being of from 2 ppm to 250 ppm;” (emphasis added)
- “wherein the method is performed at ambient temperature and an enhanced generation of hydroxyl radicals (OH*) is provided, said enhanced generation being characterized by at least a two fold increase in percentage (%) of salicylic acid (SA) conversion as compared to % conversion of SA conversion as a result of treatment with UV only.” (emphasis added)

Initially, it is noted that pending independent claim 1 is directed to a method for enhancing the formation of hydroxyl radicals in water environment in the presence of hydrogen peroxide, by the combined effect of UV irradiation, dissolved oxygen, and magnesium oxide.

The December 27, 2010 Final Office Action looks to Coury as the primary reference. The Final Office Action, at page 4, reproduces Coury’s decontamination reactor system (Figure 9 of Coury). The Examiner points to media 44 in second station 910 of Figure 9, and states “mix of MgO₂ and UV (col. 14, lines 24-29).” Initially, it is noted that Applicants believe that the Examiner mistakenly wrote the chemical formula for magnesium peroxide (MgO₂) instead of what is actually disclosed in Coury, manganese dioxide (chemical formula MnO₂):

The implication of this unexpected finding is that any economic mix of free radical sources, such as ozone or peroxide, can be used. **Also, an assortment of free radical inducers can be used, such as, but not limited to, UV, manganese dioxide, high pH, TiO₂, to force the initiation step.** (see Coury at col. 14, lines 24-29) (emphasis added)

Such media 44 is preferably in the form of manganese dioxide. The media is preferably of the type disclosed in the parent application as identified hereinabove. Other forms of free radical inducers such as titanium dioxide or ultraviolet light could readily be utilized. (see Coury at col. 14, line 67 - col. 15, line 5) (emphasis added)

The second station of FIG. 9 provides for decomposition of the ozone into free radicals, for reaction with contaminants. This objective may be accomplished by media station devices having catalytic media, such as device 910. (see Coury at col. 25, lines 11-14) (emphasis added)

Thus, Coury discloses a method that uses manganese dioxide as a free radical inducer to force the initiation step, where free radicals that are formed can react with contaminants. **Coury does not disclose, teach or suggest the use of magnesium oxide**

as part of Coury's decontamination reactor system.

The Final Office Action then looks to the secondary reference of Giamello in an attempt to cure the deficiencies of Coury. The Final Office Action seems to suggest that "magnesium oxide" taught in Giamello can replace Coury's "manganese dioxide". Applicants respectfully submit that the Examiner is using **impermissible hindsight** in constructing a hypothetical substitution utilizing magnesium oxide. Applicants note that many elements **besides** magnesium oxide are contemplated as free radical inducers. More particularly, the enormous size of the genus "free radical inducers" disclosed in Coury does not teach or suggest the specific species of alkaline earth metal oxide catalysts, to which "magnesium oxide" belongs. Moreover, since Giamello's "magnesium oxide" belongs to a species of the enormous group of species within the genus "free radical inducers", there is no teaching or suggestion to substitute Giamello's magnesium oxide for Coury's manganese dioxide. In addition, Coury **teaches away** from such a substitution because Coury expressly teaches alternative "free radical inducers" including UV, high pH, and TiO₂, none of which are alkaline earth metal oxide catalysts.

Applicants note that according to MPEP 2144.08, a prior art reference disclosing a genus is not sufficient by itself to establish a *prima facie* case of obviousness. A proper obviousness analysis includes:

- considering the size of the genus,
- considering the express teachings of the reference, and
- considering the teachings of structural similarities.

Size of the Genus

As noted above, the size of the genus of "free radical inducers" is so enormous that a person of ordinary skill in the art would not have been motivated to specifically select the species of alkaline earth metal oxide catalysts from the enormous genus "free radical inducers". Thus, as detailed above, considering the enormous size of the genus of "free radical inducers" disclosed in Coury, a prima facie case of obviousness has not been established.

Express Teachings of the Reference

The Examiner seems to suggest that the subspecies "manganese dioxide" disclosed in Coury, which, in Coury, activates hydrogen peroxide and decomposes the ozone into free

radicals for reaction with contaminants, can be replaced with the subspecies "magnesium oxide solid" disclosed in Giamello, which, in Giamello, interacts with hydrogen peroxide to transform the solid into magnesium peroxide and to subsequently trap hydroxyl radicals that are generated into the solid peroxide matrix.

While it may be true that Giamello describes "stable" radicals, it is noted that the stability is achieved only due to trapping the hydroxyl radicals in the solid magnesium peroxide matrix. That conclusion is confirmed by Giamello:

"...due to the OH hydroxyl radicals **trapped** in the bulk of magnesium peroxide" (emphasis added) (see Giamello at Introduction, 3rd paragraph, left column)

"The paramagnetic species giving rise to the spectrum in Figure 2 are **located in the bulk** of the solid. This can be stated because the line broadening shown by surface radical species when the EPR spectrum... is not observed in the present case" (emphasis added) (see Giamello at page 5736, 2nd paragraph, left column)

"The data reported in the present paper suggest an assignment of species I to an OH radical **trapped in the bulk...**" (emphasis added) (see Giamello at page 5739, 2nd paragraph, left column)

"...with three distinct paramagnetic species (i.e. the OH hydroxyl radical, and the O_2^- and O^- radical ions) simultaneously formed and **trapped in the bulk** of magnesium peroxide" (emphasis added) (see Giamello at page 5739, 4th paragraph, right column)

"As to the first radical, it is noticeable that, being **isolated in the ionic MgO₂ matrix**, it displays... To the best of our knowledge this is the first observation of a **stable hydroxyl radical in a nonaqueous matrix...**" (emphasis added) (see Giamello at Conclusions)

Thus, while being perhaps stable, the hydroxyl radicals of Giamello are trapped and isolated within the magnesium peroxide matrix. The concentration of a reactive radical obtained according to Giamello would be too low to be used in any chemical reaction, such as Coury's decontamination reactor system. Consequently, Giamello **teaches away** from the use of Coury's free radicals for reaction with contaminants. This was also confirmed by Applicants who did not detect percent of salicylic acid (SA) conversion when using any hydroxyl radicals in a hydrogen peroxide/magnesium oxide system alone. In other words, any attempt to use the trapped radicals provided by Giamello would be inefficient and essentially ineffective in Coury's decontamination reactor system.

In contrast, the quadruplet combination of magnesium oxide, hydrogen peroxide, oxygen and irradiation with UV light ($\text{MgO}/\text{H}_2\text{O}_2/\text{O}_2/\text{UV}$), as claimed in pending independent claim 1, allows the formation of hydroxyl radicals that are available for use in the treatment of the liquid aqueous biocidal mixture. Further, the quadruplet combination allows the enhanced generation of the hydroxyl radicals to an extent that they are available to provide an enhanced treatment of the biocidal mixture.

Applicants as-filed application distinguished that magnesium oxide is not a trapping agent; instead magnesium oxide's surface provides the area that allows the hydroxyl radicals to be generated and later reacted to a trapping agent like salicylic acid:

"Hydroxyl radicals may be quantified by physical or chemical methods known in the art, such as measuring redox, or reacting hydroxyl radicals with a trapping agent such as salicylic acid, etc." (See Applicants application at page 6, lines 16-19)

Thus, while Giamello may teach the use of hydrogen peroxide and magnesium oxide for generating stable, trapped radicals, those Giamello stable, trapped radicals are unavailable and ineffective for use as a reagent for treatment of a liquid biocidal mixture since the radicals, as taught by Giamello, are trapped in the magnesium peroxide matrix. Furthermore, one skilled in the art reading Giamello would not have been expected to obtain free radicals, as desired by Coury as the former explicitly states that the radicals are entrapped in the magnesium peroxide matrix, and Coury requires untrapped radicals for reaction with contaminants. Thus, as detailed above, considering the express teachings of Giamello, a *prima facie* case of obviousness has not been established.

Teachings of Structural Similarities

Manganese, a transition metal, and magnesium, an alkaline earth metal, are two entirely different chemical entities. One cannot deduce from an effect or use of a transition metal on an effect to be achieved from an alkaline earth metal. Thus, as detailed above, considering the teachings of structural similarities, a *prima facie* case of obviousness has not been established.

For at least these reasons, it is respectfully submitted that one of ordinary skill in the art would not be motivated to replace the manganese dioxide taught in Coury with the magnesium oxide solid taught by Giamello to yield Applicants method as recited in pending

independent claim 1.

In addition, Applicants have amended pending independent claim 1 to define the enhancement being "characterized by at least a two fold increase in percentage (%) of salicylic acid (SA) conversion as compared to % conversion of SA conversion as a result of treatment with UV only". This definition is supported by the data presented in FIG. 1, where it is clear that the effect of the quadruplet combination of MgO/H₂O₂/O₂/UV ("quadruplet combination") is twice greater than the effect of MgO/H₂O₂/UV and even 4 times greater than the effect of exposure to UV only.

Claim 1 has also been amended to clarify that the magnesium oxide and the pH adjustment are performed essentially together. In this connection, there is no significance to the order of addition of the two, *i.e.* the magnesium oxide may be added before or after pH adjustment as they are introduced one immediately after the other. The pH adjustment is required due to the effect of magnesium oxide on the pH and thus the two steps need to be performed in essence simultaneously.

Given such critical distinctions, Applicants respectfully submit that Coury and Giamello, alone or in combination, do not make obvious the instant invention as claimed in amended independent claim 1. Lastly, as dependent claims 5, 8 and 11-16 all depend from independent claim 1, the arguments noted above are all equally applicable to the these dependent claims. Thus, reconsideration and allowance of pending claims 1, 5, 8 and 11-16 is respectfully requested.

The Final Office Action rejected claim 19 under 35 U.S.C. § 103(a) as being unpatentable over Coury in view of Giamello and further in view of Jen. Claim 19 depends from independent claim 1, thus the arguments noted above are all equally applicable to dependent claim 19. Further, the disclosure of Jen does not cure the deficiencies of Coury and Giamello as described above. Jen describes a method for determination of hydroxyl radicals with salicylic acid. Jen does not teach or add to the teaching of Coury or Giamello for providing enhanced production, as defined in the claims, of stable OH radicals. Therefore, Applicants respectfully request reconsideration and allowance of dependent claim 19.

The Final Office Action rejected claim 20 under 35 U.S.C. § 103(a) as being unpatentable over Coury in view of Giamello and further in view of Zhou. Claim 20 depends

from independent claim 1, thus the arguments noted above are all equally applicable to dependent claim 20. Further, the disclosure of Zhou does not cure the deficiencies of Coury and Giamello as described above. Zhou describes the photoproduction of OH radicals in natural water and other liquids. Zhou does not teach or add to the teaching of Coury or Giamello for providing enhanced production, as defined in the claims, of stable OH radicals. Therefore, Applicants respectfully request reconsideration and allowance of claim 20.

New Claims 21-27

With this Amendment, new claims 21-27 have been added. No new matter is added.

New independent claim 22 is directed to a method for enhancing the formation of hydroxyl radicals in water environment in the presence of hydrogen peroxide, by the combined effect of UV irradiation, dissolved oxygen, and magnesium oxide. Support for new claim 22 is found throughout the Applicants' specification as filed, including at least page 5, lines 7-24, page 6, line 8 - page 7, line 2, and the Examples.

New dependent claims 21 and 27 further define the methods of independent claim 1 and independent claim 22, respectively, as a single pot reaction method. Support for new claims 21 and 27 is found throughout the Applicants specification as filed, including at least Example 1. As evidenced in Figure 9 of Coury, and the supporting paragraphs of Coury's specification, Coury teaches a multi stage system including at least three compartments, feed tank, first station vessel and media station, interconnected by communication means and pumps.

Support for new dependent claims 23-26 is found throughout the Applicants' specification as filed, including at least page 5, lines 19-24; FIG. 1; Examples 1-9; and the original claims.

Applicants submit that none of the references relied upon by the Office Action, either alone or in combination, disclose, teach or suggest the methods expressly recited in new claims 21-27.

CONCLUSION

In view of the foregoing remarks, Applicants respectfully request reconsideration and allowance of pending claims 1, 5, 8, 11-16 and 19-27. As the Examiner will note, Applicants have made an earnest effort to respond to all issues raised in the December 27, 2010 Final Office Action and the subsequent March 9, 2011 Advisory Action, and to place all claims currently presented in condition for allowance. No amendment made herein was for the purpose of narrowing the scope of any claim, unless Applicants have argued herein that such amendment was made to distinguish over a particular reference or combination of references.

Applicants submit that pending claims 1, 5, 8, 11-16 and 19-27 have been placed in condition for allowance, and respectfully requests an early and favorable action by the Examiner. If the Examiner believes that a telephone conversation with Applicants' attorney would expedite prosecution of this application, the Examiner is cordially invited to call the undersigned attorney of record.

The Commissioner for Patents is hereby authorized to charge any fees associated with the filing of this Amendment and RCE, to Deposit Account No. 50-1561, Reference No. 132470.010100.

Respectfully submitted,
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